Discovery Program Announcement

NASA's Science Mission Directorate (SMD) intends to release an Announcement of Opportunity (AO) for Discovery Program missions no earlier than June 2010. The Discovery Program conducts Principal Investigator–led space science investigations in SMD's planetary programs under a not-to-exceed cost cap. It is anticipated that approximately two to three Discovery investigations will be selected for nine-month Phase A concept studies through this AO. At the conclusion of these concept studies, it is planned that one Discovery investigation will be selected to continue into Phase B and subsequent mission phases.

The intended schedule for the Discovery Program solicitation.

Release of final AO (target)	No earlier than June 2010
Pre-proposal conference	~3 weeks after final AO release
Proposals due	90 days after AO release
Selection for competitive Phase A studies	March 2011 (target)
Concept study reports due	February 2012 (target)
Down-selection	July 2012 (target)
Launch readiness date	No later than December 31, 2017

The Draft Discovery AO released in December 2009 is available by following the links at http://discovery.larc.nasa.gov/. Proposers should read the Discovery AO carefully when it is released as there have been changes from the draft. Further information will be posted as it becomes available.

Questions may be addressed to Dr. Michael New, Discovery Program Lead Scientist, Science Mission Directorate, NASA, Washington, DC 20546; Tel.: (202) 358-1766; Email: michael.h.new@nasa.gov.

April 2010 • Volume 11 Number 1

INSIDE

Students Attempt Real-World Mission Design

The New Frontiers Program Office at the Marshall Space Flight Center is working with the University of Alabama Huntsville (UAH) in an education and public outreach initiative, using the current New Frontiers Announcement of Opportunity to guide a senior undergraduate-level design class project.

The project goal is to expose undergraduate and graduate students in engineering and science and high school engineering students to the NASA Science Mission Directorate (SMD) mission development process. Scientists and engineers work together to come up with scientific goals and justifications for a mission and a conceptual spacecraft design to accomplish those goals.

UAH is the engineering lead, and the College of Charleston (CoC), in Charleston, SC, is the science lead. In November, the UAH students traveled to CoC to meet the science students they would be working with during the spring semester.

Students at the College of Charleston use a sling-shot to propel rocks into a bin of dirt to simulate formation of impact craters and demonstrate how to get information about the cores of planets from the ejecta of the impact craters.

The course is modeled on the Jet Propulsion Laboratory's Planetary Science Summer School, an intensive one-week team experience designed to help prepare the next generation of scientists and engineers to participate in future solar system exploration missions.

At JPL, the trainees develop an early mission concept study, present their concept to a review board, and receive feedback. They are mentored by JPL's Advanced Projects Design Team ("Team X"). At the conclusion, students have a clearer understanding of the mission design relationships among science instruments, cost, schedule, the trade-offs necessary to assure high-quality science, and the lifecycle of a robotic space mission.

The UAH course is taught by Dr. Michael Benfield and Dr. Matthew Turner, who participated in the JPL experience in 2009. They are expanding the concept to give students two semesters to plan and design a mission. With financial assistance from the New Frontiers Program Office and support from NASA's SMD, the project offers the students the opportunity to translate a customer's needs into a viable design activity and to get feedback from a review board composed of Discovery and New Frontiers Program staff, government and industry participants, and technical mentors. The UAH project is prohibited from using any proprietary, sensitive, or privileged data. All data obtained by UAH and their partners come from open systems, and all data generated by the project will be publically available.

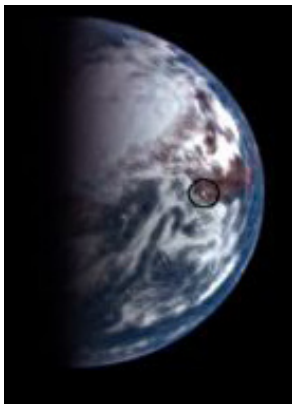
The first mission review was held March 4. The final mission concept review and selection of the best mission will be held May 6. The Board will select the best mission using the AO criteria with minor modifications.

About 300 people at the high school, undergraduate, and graduate levels are involved in this first collaborative mission design opportunity. The high school project involves students from Austin and Decatur High Schools in Decatur, AL, who are working to understand the design process and develop an experiment that meets the design requirements. Other colleges and high schools have expressed interest in participating in future opportunities.

EPOXI Prepares for Comet Encounter

The EPOXI mission is preparing for its next cosmic encounter, little more than six months away. The science and operations teams met to lay out the detailed sequence of observations to be made during the encounter with comet Hartley 2. Observations will begin 60 days prior to closest approach and continue for 21 days after. The details must be decided well in advance to allow time for simulator testing to ensure that everything operates as planned.

The very capable, multi-tasking spacecraft first known as Deep Impact has already performed in an exemplary manner. First it released a copper impactor into the path of comet Tempel 1 in 2005, giving scientists the first look inside a comet and greatly expanding our knowledge about comets.



Two new mission videos show how bright flashes of light, known as sun glints, signal large bodies of water on Earth. These observations give scientists a way to recognize indications of the presence of liquid oceans or lakes on extrasolar planets, increasing the chances of finding life.

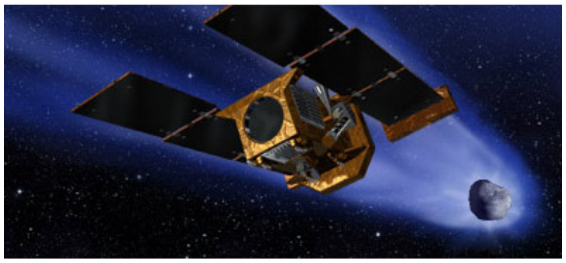
Then, as part of its new assignment in 2008, it performed observations of stars with known transiting giant planets for the Extrasolar Planet Observation and Characterization (EPOCh) portion of the new investigation. EPOCh also observed the Earth in visible and infrared wavelengths to allow comparisons with future discoveries of Earth-like planets around other stars.

As if that's not already enough for one over-achieving Discovery spacecraft, NASA used the spacecraft during a month-long series of demonstrations in October 2008 and a subsequent testing activity this spring to successfully test the Interplanetary Internet, the first deep space communications network modeled on the Internet.

Now as the EPOCh team moves from processing data to writing papers about their results, the DIXI (Deep Impact eXtended Investigation) team is preparing for the encounter with comet Hartley 2 on November 4. The flyby will add to the body of cometary knowledge obtained from other missions plus offer comparisons with data collected previously at comet Tempel 1. Data gathered from the two comets with the exact same instruments will be particularly useful for determining which cometary features represent primordial differences and which result from subsequent evolutionary processes. Plus, Hartley 2 is smaller and more active than Tempel 1, which adds additional interest to the comparison.

Education and Public Outreach Highlights

EPOXI released issue #9 of the EPOXI Mission Outreach Newsletter. Emailed to 16,582 recipients, it included an update from the Principal Investigator, new biographies of mission team members, and educational links. EPOXI also participated in five Family Science Nights that were held in the Washington, DC, area to serve underprivileged students.



Stardust-NExT on Course for Tempel 1

Above: Artist's concept of Stardust-NExT at Tempel 1.

The Stardust-NExT (New Exploration of Tempel 1) mission is less than one year from its encounter with comet Tempel 1. The science team met in early January to complete their study on comet rotation modeling and other observation data. Later in the month the project team jointly recommended a time-of-arrival adjustment. Delaying the arrival at Tempel 1 by eight hours will maximize the probability of providing high-resolution images of the desired surface features.

The navigation team determined the necessary adjustment, and the spacecraft team commanded the execution of Trajectory Correction Maneuver (TCM) 28 on Feb. 17. This burn took 23 minutes and resulted in a change in velocity of approximately 24 m/sec.

At the end of March, the project conducted an encounter planning meeting with the spacecraft and science teams. One goal was to define the requirements for the encounter sequence development. The day-by-day activities for the remainder of the mission were identified. The focus of the meeting was on science requirements

for the 120-day encounter period and how the flight team can best achieve them.

On Jan. 21, the Stardust spacecraft celebrated 4,000 days of flight and approximately 4 billion miles of travel. The original Stardust project was the first U. S. space mission dedicated to the exploration of a comet, and the first robotic mission designed to return extraterrestrial material from outside the orbit of the Moon.

Launched on Feb. 7, 1999, Stardust's primary goal was to collect dust and carbon-based samples during its close encounter with comet Wild 2 in January 2004 and return those particles back to Earth for analysis in January 2006. Additionally, Stardust collected and returned samples of interstellar dust. Analysis of these primordial materials has yielded important insights into the evolution of the Sun, the planets, and possibly even the origin of life itself.

In July 2007, the spacecraft was taken out of hibernation and recommissioned for an exciting new journey to rendezvous with comet Tempel 1. The images and data collected will be compared with data previously taken by the Deep Impact spacecraft in July 2005. A goal of the mission is to snap photos of the crater made by Deep Impact's copper projectile. The encounter is timed to provide project scientists the best chance of seeing both previously imaged areas and new areas of Tempel 1. With new photos of previously imaged areas of the comet, scientists can analyze changes caused by the comet's most recent close approach to the Sun.

Education and Public Outreach

The Stardust-NExT education team met in March to plan future activities and events. Team members/teachers Dee McClellan and Martin Horesji demonstrated new activities they have created to help promote the science of the mission.

Stardust-NExT has partnered with Way Cool Science and the Denver Public Schools Distant Learning Department on a program that focuses on NASA's exploration of comets, highlighting both past and present missions. It will also feature jobs in the aerospace industry and introduce educational activities relating to the mission. The series on the Stardust-NExT mission will be shown this spring.

Stardust-NExT is looking for educators to beta-test three new educational activities. Anyone who is interested can get further detail in the Features section on the mission homepage.

MESSENGER on Final Leg Toward Mercury

The MESSENGER mission successfully completed its fifth and final deep-space maneuver on Nov. 24, in preparation for its critical Mercury orbit insertion maneuver in less than one year.

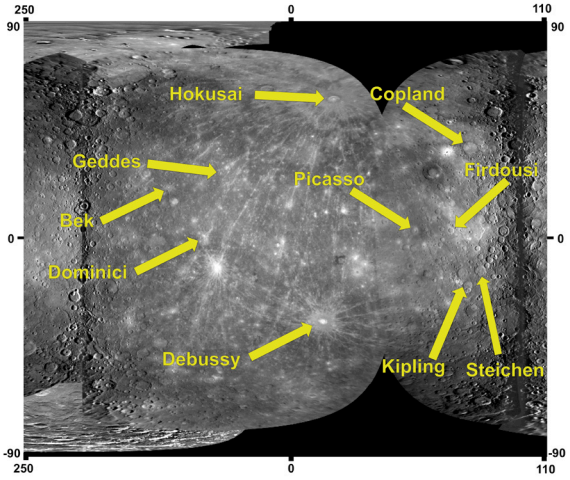
On Dec. 12, MESSENGER's MASCS instrument (Mercury Atmospheric and Surface Composition Spectrometer) completed a set of measurements coordinated with an instrument on the European Space Agency's Venus Express mission. The collaborative observations take advantage of the unique opportunity of having similar instruments in the vicinity of Venus and Mercury to measure interplanetary hydrogen between the two.

At the Fall Meeting of the American Geophysical Union in San Francisco in December, the MESSENGER mission team and cartographic experts from the U. S. Geological Survey gave a presentation on a global mosaic map of Mercury that will help scientists pinpoint craters, faults, and other features for observation. This first global map will be a critical tool for planning the first orbital observations of Mercury. It was created from images taken during the MESSENGER spacecraft's three flybys of the planet and those of Mariner 10 in the 1970s.

On Feb. 27, MESSENGER crossed the four-billion-mile mark since its launch. The probe has completed about 81 percent of its journey toward its destination to be the first spacecraft to orbit the planet Mercury. To counter the strong gravitational pull of the Sun, MESSENGER has taken a long and complex route driven by an innovative trajectory that uses the gravity of Earth, Venus, and Mercury itself to slow and shape the probe's descent into the inner solar system. MESSENGER will enter orbit about Mercury on March 18, 2011.

In March, the International Astronomical Union (IAU) approved a proposal from the MESSENGER Science Team to confer names on 10 impact craters on Mercury. The newly named craters were imaged during the mission's three flybys of Mercury in January and October 2008 and September 2009.

The IAU has been the decision maker for planetary and satellite nomenclature since its inception in 1919. In keeping with the established naming theme for craters on Mercury, all of the craters are named after famous deceased artists, musicians, or authors. Naming allows the craters to be clearly identified in the scientific literature.



Mercury's 10 newly named craters.

Education and Public Outreach Highlights

"MESSENGER Exploring the Inner Solar System" podcasts are being featured the second Friday of each month through 2010 as part of "365 Days of Astronomy," the daily podcasts of the International Year of Astronomy.

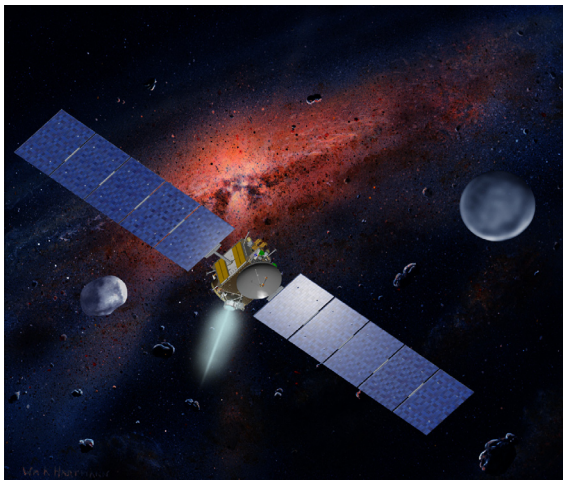
Ten new MESSENGER Educator Fellows are being recruited through an announcement of opportunity released in March. The Fellows program is a nationwide teacher training initiative whereby a cadre of thirty master science educators conduct teacher training workshops nationally, training up to 27,000 grades pre-K–12 educators over the mission lifetime. Fellows train educators on education materials (termed MESSENGER Education Modules) developed by the MESSENGER education and public outreach team. To date, over 14,000 educators across the nation have been trained by the MESSENGER Educator Fellows.

Discovery's MESSENGER and EPOXI missions are participating in Family Science Nights at the Smithsonian's National Air and Space Museum. The event held on Feb. 22 drew 353 participants from 11 Washington, DC, area schools.

Dawn Continues Full Speed Ahead

The Dawn spacecraft continues on its journey to asteroid Vesta, with arrival planned for July 2011. Dawn will orbit Vesta for a full year, departing in July 2012 to reach dwarf planet Ceres by February 2015.

During the long cruise, the mission operations team guides the spacecraft toward its destination and monitors its health in a variety of ways. Other tasks include testing and updating flight software and powering on, calibrating, and operating the science instruments.



Artist's concept of Dawn and its two asteroid belt targets.

Credit: Background-William K. Hartmann, Courtesy of UCLA; image-NASA/MCREL

The spacecraft spends most of its time gradually changing its orbit around the Sun by thrusting with its ion propulsion system. The probe is outfitted with three ion thrusters, but only uses one thruster at a time. All three were tested during the 80-day initial checkout phase of the mission. During the interplanetary cruise phase, which commenced in December 2007, each will have a chance to power the craft. In contrast to conventional chemical propulsion systems, ion propulsion achieves its incredibly high performance by using electrical power to create the thrust. Outfitted with the most powerful solar arrays ever carried on an interplanetary probe, Dawn converts sunlight into the electricity that is consumed by the ion thrusters.

Dawn is currently 1.43 AU from Earth, with another 0.56 AU to go to reach Vesta.

Education and Public Outreach Highlights

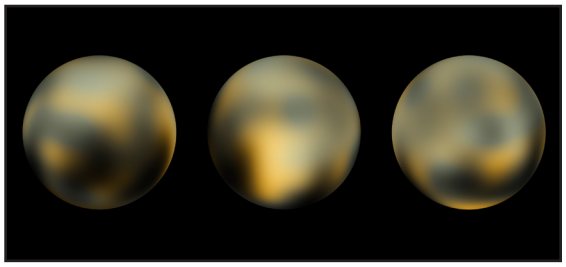
Dawn has added two new interactives to their web site. One illustrates how scientists will use the Gamma Ray and Neutron Detector (GRaND) Instrument to learn about the composition of an asteroid by studying energy and neutrons that emanate from it. The other explains how the Visual and Infrared Imaging Spectrometer works.

In January Dawn participated in a Meteorite Exhibit at the New Mexico Museum of Natural History and Science.

Dawn published its E-Bulletin in February, noting that on Feb. 17, Vesta was at opposition, orbiting at its closest point to Earth. The asteroid was expected to shine at magnitude 6.1, making it visible in the night sky with a telescope or binoculars.

The project's chief engineer, Dr. Marc Rayman, continues to write his monthly Dawn Journal, providing a wealth of details about the spacecraft's adventures through the solar system.

New Horizons Team Continues Pluto Planning



Above: This is the most detailed view to date of Pluto's entire surface, as constructed from multiple Hubble photographs. The center disk has a mysterious bright spot that is unusually rich in carbon monoxide frost.

Credit: NASA, ESA, and M. Buie (Southwest Research Institute).

In November, the New Horizons spacecraft successfully completed 10 days of active operations, then was transitioned back into hibernation mode. The main goal of the wake-up period was to repoint the communications dish antenna to keep up with the changing position of the Earth around the Sun. The spacecraft was transitioned out of hibernation again in January for 10 days to collect data and perform scheduled work with some of the instruments.

At the end of December, the mission to Pluto marked a major milestone. After nearly 4 years of zooming through the solar system, the mighty spacecraft is now closer to Pluto than it is to the Earth.

The mission ground team has completed most of the encounter commands for the nine-day, Pluto-closest-approach in 2015. The team is also planning this summer's Active Checkout (ACO-4), which will run from late May to early July. ACO-4 will include a complete spacecraft and instrument checkout, instrument calibrations, a trajectory correction maneuver, science focusing on the interplanetary environment, Uranus and Neptune imaging, and the first full-length encounter mode test on the spacecraft.

In February, NASA released the most detailed set of images ever taken of the distant dwarf planet Pluto. The images taken by NASA's Hubble Space Telescope show an icy and dark molasses-colored, mottled world that is undergoing seasonal changes in its surface

At the end of December, the mission to Pluto marked a major milestone. After nearly 4 years of zooming through the solar system, the mighty spacecraft is now closer to Pluto than it is to the Earth.

color and brightness. Pluto has become significantly redder, while its illuminated northern hemisphere is getting brighter. These changes are most likely consequences of surface ices sublimating on the sunlit pole and then refreezing on the other pole as the dwarf planet heads into the next phase of its 248-year-long seasonal cycle. The dramatic change in color apparently took place in a two-year period, from 2000 to 2002. The pictures show that Pluto is not just a ball of ice and rock but a dynamic world that undergoes dramatic atmospheric changes.

The Hubble images will remain our sharpest view of Pluto until New Horizons is within six months of its Pluto flyby. The Hubble pictures

Alan Stern and Neil deGrasse Tyson in the New Horizons control room for NOVA's episode on Pluto, its planethood, and New Horizons.

are being used to select the planet's most interesting-looking hemisphere for the flyby in 2015.

Education and Public Outreach Highlights

In November, a crew from the PBS television series NOVA visited New Horizons at the Applied Physics Lab for a special called "The Pluto Files," hosted by Neil deGrasse Tyson, that aired in March. The episode was based on Tyson's book of the same name. Principal Investigator Alan Stern was interviewed in the mission control center to discuss Pluto's planethood.

Mars Express Gets Close to Phobos

On March 3, Mars Express, a European Space Agency mission that launched from Russia in June 2003, skimmed past the Martian moon Phobos from 50 km, the closest any manmade object has ever approached the mysterious moon. The data collected by the spacecraft's seven instruments could help unlock the origin of not just Phobos but other "second generation" moons.

ASPERA-3, one of the scientific instruments aboard the spacecraft, was partially funded by NASA as a Discovery Mission of Opportunity. ASPERA-3 studies the interaction between the solar wind and the atmosphere of Mars. It also characterizes the plasma and neutral gas environment in the near-Mars space.

The main objective of the Mars Express mission is to search for subsurface water from orbit using remote sensing measurements to answer questions about the Martian atmosphere, structure and geology. Since arriving at Mars on Dec. 25, 2003, Mars Express orbits the Red Planet in a highly elliptical, polar orbit that brings it close to Phobos every five months. It is the only spacecraft currently in orbit around Mars whose orbit reaches far enough from the planet to provide a close-up view of Phobos.

Phobos as seen by the High Resolution Stereo Camera on Mars Express. This image was enhanced to bring out features in the less-illuminated part. Resolution: about 9 m/pixel.

Credits: ESA/DLR/FU Berlin (G. Neukum)

Like our Moon, Phobos always shows the same side to the planet, so by flying outside the orbit it becomes possible to observe the far side. During a flyby campaign that took place during February and March, all seven instruments onboard Mars Express were used to study Phobos. Images from the flyby show Mars' rocky moon in exquisite detail.

Phobos is an irregular body measuring $27 \times 22 \times 19$ km. Its origin is debated. It appears to share many surface characteristics with the class of "carbonaceous C-type" asteroids, which suggests it might have been captured from this population. However, the capture mechanism and the subsequent evolution of the orbit remain a mystery. An alternative hypothesis is that it formed around Mars, and is a remnant from the planetary formation period. Extensive data about the gravitational field of Phobos from the recent flybys may help determine its distribution of mass and provide answers about its origin. Phobos may turn out to be a "second-generation solar system object," meaning that it coalesced in orbit after Mars formed, rather than forming concurrently out of the same birth cloud as the Red Planet. There are moons around other planets where this is thought to be the case, such as Amalthea around Jupiter.

Juno Assembly Begins April 1

No fooling — nearly five years after being selected as the second New Frontiers mission, assembly of the Juno spacecraft has begun. Scheduled to launch in August 2011, Juno will greatly add to our body of scientific understanding and discovery by conducting an in-depth study to reveal the origin and evolution of Jupiter.

Workers in the high-bay cleanroom at Lockheed Martin Space Systems in Denver, CO, ready the spacecraft's propulsion module.

Leading up to the ATLO (Assembly, Test, and Launch Operations) mission phase, the Juno mission team conducted many reviews associated with readiness of the various instruments and subsystems. In December, three Manufacturing Readiness Reviews were held — two for flight system components and one instrument component. All three reviews were successful, providing concurrence to begin manufacturing. Also in December, the team completed a Solar Array Critical Design Review to examine the final design details for a portion of the solar array manufacturing.

In January, Juno held a Science Team Meeting at Malin Space Science Systems in San Diego, CA. The Science Planning Working Group

and the Science Operations Working Group each conducted full-day sessions.

The Juno team conducted one-day workshops in February at Lockheed Martin-Denver in preparation for the Systems Integration Review. Also in February, the Juno Ultra-Violet Spectrograph team held a Test Readiness Review at Southwest Research Inc. in San Antonio, TX, and the Spacecraft Test Lab team conducted a test of the Jovian Auroral Distribution Experiment Engineering Development Unit at LM-Denver. The Juno Magnetometer team conducted a pre-ship review for the Advanced Stellar Compass at Danish Technical University in Denmark. The Juno Payload Office completed the final instrument Manufacturing Readiness Review (MRR) for the Waves Instrument Electronics. This was the last of 40 MRRs conducted for the Juno instruments.

The Juno System Integration Review at LM-Denver was completed on March 4. Later in the month, the Juno ATLO team completed multiple ATLO Integration Readiness Reviews. Passage of these reviews led to the official start of the ATLO phase on April 1.

Education and Public Outreach Highlights

Juno is participating in an "Outer Planets Exploration" exhibit that is scheduled for display on July 15 on Capitol Hill in Washington. The exhibit debuted at the Lunar and Planetary Science Conference in Houston in March, and will also appear at JPL's annual Open House May 15–16. The exhibit ties current and future exploration of Jupiter and Saturn by NASA and the European Space Agency to the 400th anniversary of Galileo's great discoveries.

GRAIL Starts Development

The Gravity Recovery And Interior Laboratory, or GRAIL, will fly twin spacecraft in tandem around the Moon for several months to measure its gravity field in unprecedented detail to reveal differences in density of the Moon's crust and mantle. The mission will help answer longstanding questions about the Moon and provide a better understanding of how Earth and other rocky planets in the solar system formed.

After a successful System Critical Design Review in November, NASA's Center Management Council recommended the GRAIL project continue into the development phase and prepare for System Integration Review, which is scheduled for June.

The GRAIL team continues to conduct extensive tests and reviews on the spacecraft and work through issues that arise, in anticipation of a September 2011 launch.

Education and Public Outreach Highlights

Dr. Maria Zuber, GRAIL's Principal Investigator, conducted a seminar on Lunar Geophysics at the Institute for Space Research in Moscow on Jan. 30. Fifty scientists from the Institute, Moscow State University, and the Russian Academy of Sciences attended.

The GRAIL E/PO team conducted MoonKAM workshops for educators in February and March at the Space Exploration Educators Conference in Houston, the Sally Ride Science Festival at Tulane University in New Orleans, and at the National Science Teachers Association annual conference in Philadelphia. MoonKAM, GRAIL's signature education and public outreach program, is led by Dr. Sally Ride, America's first woman in space, and her team at Sally Ride Science, in collaboration with undergraduate students at the University of California San Diego.

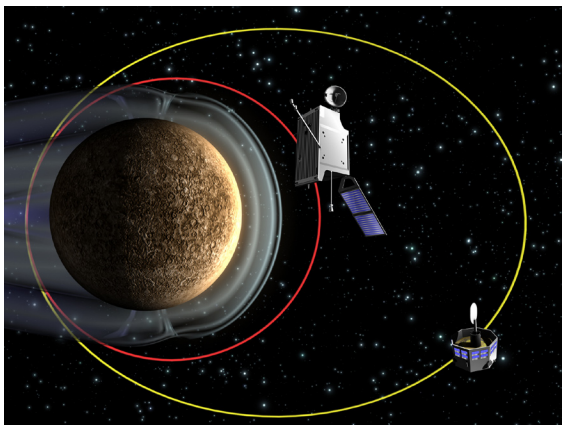
The GRAIL MoonKAM mission will begin in 2012 when the GRAIL satellites are in orbit around the Moon and the dedicated MoonKAM cameras are activated. The mission will last approximately 80 days. Teachers can register to participate now.

Strofio Project Continues Development

In May 2009, NASA selected Strofio as a Discovery Mission of Opportunity. Strofio is part of the SERENA (Search for Exospheric Refilling and Emitted Natural Abundances) instrument package that will fly onboard the European Space Agency's BepiColombo/Mercury Planetary Orbiter (MPO). It will map the planet and investigate the complex particle environment that surrounds it.

BepiColombo also includes a Mercury Magnetospheric Orbiter (MMO), to investigate the planet's magnetosphere. The MMO is being built by the Japan Aerospace Exploration Agency (JAXA).

Strofio will employ a unique mass spectrometer to reveal the composition of Mercury's thin atmosphere, or exosphere. The investigation will study the exosphere, which is formed from material ejected from its surface, to reveal the composition of Mercury's surface. The mission is scheduled for launch in 2013.



Artist's impression of the two BepiColombo spacecraft, the Mercury Planetary Orbiter and the Mercury Magnetospheric Orbiter, in their elliptical polar orbits around Mercury.

Credits: ESA—image by C. Carreau

The project conducted the Strofio Instrument Requirements Review (IRR) at Southwest Research on Dec. 1. The Independent Review Board determined that the project met the Strofio IRR success criteria.

Efforts since the IRR include refining the integrated master schedule, finalizing international agreements, component development, subsystem reviews, working mechanical and electrical interfaces with SERENA, determining board schematics and layouts, selecting flight parts and packaging designs, and much more.

Principal Investigator Stefano Livi attended a BepiColombo Science Working Team meeting in March.

Coming Soon — *Space School Musical*

The Discovery and New Frontiers Programs education and public outreach manager has partnered with KidTribe to create an exciting and unique solar system learning activity that is fun, funny, and timeless — *Space School Musical*. View the trailer here.

The interdisciplinary activity integrates science with music, performing arts, and physical fitness while also addressing social themes and providing leadership opportunities.

The musical play centers around Hannah, a student who loves space and is working hard to finish her science project, a model of the solar system. She travels through the cosmos and meets up with the quirky inhabitants of our solar system who teach her important lessons along the way.

Nine original songs in many styles convey the science content with memorable and entertaining lyrics. Students can watch the play, learn the songs, do the hands-on science activities, and perform the play themselves. Complete with simple staging and costuming instructions, it can be performed in numerous settings, including schools, afterschool programs, camps, or science centers.

The comprehensive package will include:

- DVD of the 30-minute play as performed by 30 students from Los Angeles Hamilton High School Academy of Music
- CD with songs recorded with and without lyrics, to allow singing or lip-syncing to the songs
- Booklet with script, lyrics, stage directions, costume suggestions, set construction, props, and materials lists
- Educational activities, glossary, web links to NASA career information

It will be available to all with free distribution through the Internet.

Written and edited by:

Shari Asplund

Discovery & New Frontiers Program
Education and Public Outreach Manager

www.nasa.gov